Section I. (Listing of Claims)

1-23. (Cancelled).

24. (Previously Presented) A cell culture device for in vitro cell population growth, the cell growth occurring in fluid growth media within the device, the device comprising:

a. a first hollow fiber cartridge having a housing and a plurality of capillaries, each of the capillaries including walls having interiors and exteriors, the housing having a first inflow opening and a first outflow opening, the plurality of capillaries extending between the first inflow opening and the first outflow opening, at least one of the capillaries having selectively permeable walls, the interiors of the walls of the plurality of capillaries defining a first lumen extending between and being in fluid communication with the first inflow opening and the first outflow opening, the exteriors of the walls of the plurality of capillaries and the housing defining a first extracapillary space, the housing having a first primary orifice in fluid communication with the first extracapillary space;

b. a second hollow fiber cartridge having a housing and a plurality of capillaries, each of the capillaries including walls having interiors and exteriors, the housing having a second inflow opening and a second outflow opening, the plurality of capillaries extending between the second inflow opening and the second outflow opening, at least one of the capillaries having selectively permeable walls, the interiors of the walls of the plurality of capillaries defining a second lumen extending between and being in fluid communication with the second inflow opening and the second outflow opening, the exteriors of the walls of the plurality of capillaries and the housing defining a second extracapillary space, the housing having a second primary orifice in fluid communication with the second extracapillary space; and

c. a fluid connecting mechanism for fluidly connecting the first and second cartridges, the fluid connecting mechanism including a recirculation mechanism for recirculating fluid media from the respective outflow openings of the hollow fiber cartridges to inflow openings thereof and an extracapillary space connecting mechanism for fluidly connecting the first extracapillary space with the second extracapillary space, the recirculation mechanism including a mechanism for providing oxygen to the media.

25. (Previously presented) A cell growing device for in vitro cell population growth, the cell growth occurring in fluid growth media within the device, the device comprising:

a. a plurality of first hollow fiber cartridges, each of the plurality of first hollow cartridges having a housing and a plurality of capillaries, each of the capillaries including walls having interiors and exteriors, the housing having a first inflow opening and a first outflow opening, the plurality of capillaries extending between the first inflow opening and the first outflow opening, at least one of the capillaries having selectively permeable walls, the interiors of the walls of the plurality of capillaries defining a first lumen extending between and being in fluid communication with the first inflow opening and the first outflow opening, the exteriors of the walls of the plurality of capillaries and the housing defining a first extracapillary space, the housing having a first primary orifice in fluid communication with the first extracapillary space;

b. a plurality of second hollow fiber cartridges, each of the plurality of second hollow cartridges having a housing and a plurality of capillaries, each of the capillaries including walls having interiors and exteriors, the housing having a second inflow opening and a second outflow opening, the plurality of capillaries extending between the second inflow opening and the second outflow opening, at least one of the capillaries having selectively permeable walls, the interiors of the walls of the plurality of capillaries defining a first lumen extending between and being in fluid communication with the second inflow opening and the second outflow opening, the exteriors of the walls of the plurality of capillaries and the housing defining a second extracapillary space, the housing having a second primary orifice in fluid communication with the second extracapillary space;

c. a fluid connecting mechanism for fluidly connecting the plurality of first cartridges with the plurality of second cartridges, the first cartridges being connected in parallel and the second cartridges being connected in parallel, the fluid connecting mechanism including a recirculation mechanism for recirculating fluid media from the respective outflow openings of the hollow fiber cartridges to inflow openings thereof and extracapillary space connecting mechanism for fluidly connecting the extracapillary spaces of the plurality of first cartridges with those of the plurality of second cartridges; and

d. a valve mechanism for controlling the flow of fluid media through the fluid connecting mechanism, the valve mechanism including a switch mechanism for selectively switching the flow of media between alternate fluid pathways.

26. (Previously presented) A cell growing device for in vitro cell population growth, the cell growth occurring in fluid growth media within the device, the device comprising:

a. a first hollow fiber cartridge having a housing and a plurality of capillaries, each of the capillaries including walls having interiors and exteriors, the housing having a first inflow opening and a first outflow opening, the plurality of capillaries extending between the first inflow opening and the first outflow opening, at least one of the capillaries having selectively permeable walls, the interiors of the walls of the plurality of capillaries defining a first lumen extending between and being in fluid communication with the first inflow opening and the first outflow opening, the exteriors of the walls of the plurality of capillaries and the housing defining a first extracapillary space, the housing having a first primary orifice in fluid communication with the first extracapillary space;

b. a second hollow fiber cartridge having a housing and a plurality of capillaries, each of the capillaries including walls having interiors and exteriors, the housing having a second inflow opening and a second outflow opening, the plurality of capillaries extending between the second inflow opening and the second outflow opening, at least one of the capillaries having selectively permeable walls, the interiors of the walls of the plurality of capillaries defining a second lumen extending between and being in fluid communication with the second inflow opening and the second outflow opening, the exteriors of the walls of the plurality of capillaries and the housing defining a second extracapillary space, the housing having a second primary orifice in fluid communication with the second extracapillary space; and

c. a fluid connecting mechanism for fluidly connecting the first and second cartridges, the fluid connecting mechanism including a recirculation mechanism for recirculating fluid media from the respective outflow openings of the hollow fiber cartridges to inflow openings thereof and an extracapillary space connecting mechanism for fluidly connecting the first extracapillary space with the second extracapillary space.

27. (Previously presented) The cell growing device of claim 26, wherein the device further includes a monitoring mechanism for monitoring and adjusting the oxygen concentration and the pH of the media located in the first extracapillary space.

28. (Previously presented) The cell growing device of claim 27, wherein the extracapillary space monitoring mechanism includes a gas transfer mechanism.

29. (Cancelled).

30. (Previously presented) A cell culture system comprising:

a. a plurality of cell culture chambers each comprising cells in a culture medium;

b. a gas-liquid exchange device;

c. a conduit system to conduct culture medium between said gas-liquid exchange device and said plurality of cell culture chambers;

d. a circulation mechanism for circulating culture medium through said conduit system, said plurality of cell culture chambers, and said gas-liquid exchange device, including circulating culture medium between said plurality of cell culture chambers.

31. (Previously presented) A method for culturing cells, the method comprising:

a. providing cell culturing system comprising:

i. a plurality of cell culture chambers;

ii. a gas-liquid exchange device;

iii. a conduit system to conduct culture medium between said gas-liquid exchange device and said plurality of cell culture chambers; and

iv. a circulation mechanism for circulating culture medium through said conduit system; and

b. circulating the culture medium through said plurality of cell culture chambers, said gas-liquid exchange device, and said conduit system with said circulation mechanism.

32. (Previously presented) A method for culturing cells, the method comprising:

a. placing a source of cells into a perfusable cell culture device said device comprising:

i. two liquid impermeable polymeric film sheets constructed so as to deliver oxygen and carbon dioxide at rates sufficient to maintain cells in culture joined together at their peripheral edges in a sealing manner, one of the sheets defined as an upper polymeric layer and the other defined as a lower polymeric layer;

ii. a gas and liquid permeable flow divider membrane affixed between said upper polymeric layer and said lower polymer layer and affixed to said lower polymeric layer so as to provide channels for fluid distribution with a pressure drop across the flow divider membrane;

iii. an inlet port in said lower polymeric layer through which culture medium can be introduced between said lower polymeric layer and said flow divider membrane;

iv. said upper polymeric layer and said flow divider membrane being arranged with respect to each other so as to form a chamber between said upper polymeric layer and said flow divider membrane through which growth medium can be perfused across the surface of the flow divider membrane and in which cells are cultured; and

v. a port in said upper polymeric layer through which cells may be placed into the cell culture device, cultured cells may be removed from said cell culture device, and perfused nutrients may be collected from said cell culture device;

b. perfusing said device with a cell culture medium; and

c. withdrawing spent culture medium through said port in the upper polymeric layer.

33. (Previously presented) A cell propagation system comprising:

a. at least two hollow fiber bioreactors each of said bioreactors comprising:

i. a casing;

ii. hollow fibers positioned in said casing;

iii. an extracapillary space defined by the interior surface of said casing and the exterior surfaces of said hollow fibers;

iv. a first inlet means for fluid flow into the lumens of said hollow fibers;

v. a second inlet means for fluid flow into said extracapillary space;

vi. said second inlet means further comprising valve means for the control of fluid separately through said extracapillary space of each of said bioreactors;

vii. a first outlet means for withdrawal of fluid from the lumens of said hollow fibers;

viii. a second outlet means for withdrawal of fluid from said intracapillary space;

b. a fluid flow path connecting said first inlet and said first outlet means of each of said bioreactors; and

c. a fluid flow path connecting said second inlet means and said second outlet means of each of said bioreactors.

34. (Previously presented) The cell propagation system of claim 33 further comprising means for providing a controlled fluid flow rate through said fluid flow path connecting said second inlet means and said second outlet means of each of said bioreactors.

35. (Previously presented) The cell propagation system of claim 33 further comprising means for introduction of nutrients into said fluid flow path.

36-38. (Cancelled).

39. (Previously presented) A cell culture device comprising:

a. a first casing that defines a cell growth chamber configured to carry a quantity of biological cells and growth media;

b. a source of growth medium connected to the cell growth chamber;

c. a port connected to the cell growth chamber configured to carry media discharged from the growth chamber;

wherein the cell growth chamber, the source of growth medium, and port are connected together to form a closed system configured to be sterilizable as a unit; and

d. a flow control device for transporting growth media through the cell growth chamber, from the from the source of growth medium and through the exit port without exposing the closed, sterile system to the external environment;

wherein the cell growth chamber is configured to be inoculated with biological cells, and thereafter to maintain and grow the inoculated biological cells while the flow control device transports growth media through the cell growth chamber, from the from the source of growth medium and through the exit port without exposing the closed, sterile system to the external environment.

40. (Previously presented) A cell culture device comprising;

a. a housing;

b. a cell culture space within said housing;

c. fresh nutrient medium inlet and outlet means, connected, in parallel, to tubes contacting said culture space;

d. gas supply means for supplying metabolic gas to the cell culture space;

e. a spent medium outlet means;

wherein said tubes in connection with fresh nutrient medium inlet and outlet means, which are structured in a closed-loop circuit, are constructed so as to provide a supply of fresh medium through said tubes.

41-83. (Cancelled).

84. (Previously presented) A method of culturing cells, comprising:

a. providing a tangential flow membrane device;

b. providing a culture fluid in loop fluid communication with the tangential flow membrane device;

c. flowing culture fluid through the tangential flow membrane device on a first side of a membrane thereof;

d. discharging a fluid from the tangential flow membrane device from a second side of said membrane thereof;

e. monitoring the culture fluid for at least one process parameter, and responsively inoculating the culture fluid with a microorganism, and/or adding one or more supplements to enable growth of said microorganism, wherein said supplement(s) comprises at least one of oxygen, culture media, acids, bases, buffers and cellular nutrients.

85. (Previously Presented) A mass transfer system comprising:

(a) a first tangential flow membrane assembly comprising one or more filter elements separating the interior volume of said first tangential flow membrane assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(b) a second tangential flow membrane assembly in fluid communication with one or more of the chambers of the first tangential flow membrane assembly, said second tangential flow membrane assembly comprising one or more filter elements separating the interior volume of said second tangential flow membrane assembly into two or more chamber, including a first sets of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(c) one or more substance addition means in fluid communication with the extra-filter volume or intra-filter volume of the first and/or second tangential flow membrane assembly; and

(d) one or more fluid exit means in fluid communication with the extra-filter volume or intra-filter volume of the first and/or second tangential flow membrane assembly.

86. (Previously presented) The mass transfer system of claim 85, further comprising a reservoir in fluid communication with the substance addition means, said reservoir containing a fluid comprising an aqueous solution.

87. (Previously presented) The mass transfer system of claim 85, further comprising means for flowing fluid through the intra-filter volume or extra-filter volume of the first and/or second tangential flow membrane assemblies.

88. (Previously presented) The mass transfer system of claim 87, wherein said fluid comprises an aqueous solution.

89. (Previously presented) The mass transfer system of claim 87, further comprising a reservoir arranged in a path of fluid communication:

(a) which exits the intra-filter volume at a first position and enters the intra-filter volume at a second position; or which

(b) exits the extra-filter volume at a first position and enters the extra-filter volume at a second position.

90. (Previously presented) The mass transfer system of claim 85, further comprising one or more ultrafilter devices, each arranged in fluid communication with the extra-filter

volume and/or the intra-filter volume of the first and/or second tangential flow membrane assembly.

91. (Previously presented) The mass transfer system of claim 90, wherein the ultrafilter device comprises:
(a) a reservoir;
(b) a tangential flow membrane device in fluid communication with the reservoir, suitable for concentrating cells, metabolites of cells, and/or virus; and
(c) a means for removing a fluid from the reservoir and forcing the fluid through the ultrafilter and back to the reservoir with sufficient power to generate an ultrafiltrate stream.

92. (Previously presented) The mass transfer system of claim 91, wherein the means for removing the fluid from the reservoir and forcing the fluid through the ultrafilter comprises a pump.

93. (Previously presented) The mass transfer system of claim 85 wherein the filter elements comprise one or more hollow fiber filters.

94. (Previously presented) The mass transfer system of claim 85 wherein the first and/or second tangential flow membrane assembly are positioned side-by-side.

95. (Previously presented) The mass transfer system of claim 85 wherein the first and/or second tangential flow membrane assembly comprises multiple filter elements in parallel or serial connection.

96. (Previously presented) The mass transfer system of claim 85 further comprising a reservoir in fluid communication with the substance addition means.

97. (Previously presented) The mass transfer system of claim 96 wherein the reservoir contains a fluid comprising a growth medium for a culturable organism.

98. (Previously presented) The mass transfer system of claim 85 further comprising means for circulating fluid through the intra-filter volume or extra-filter volume of the first and/or second tangential flow assembly.

99. (Previously presented) The mass transfer system of claim 98 wherein means for circulating fluid comprises:

(a) a means for circulating fluid in the intra-fiber volume of the first and/or second tangential flow membrane assembly comprising:

i. a means for providing a path of fluid communication for removing fluid from a first portion of the intra-fiber volume of the first and/or second tangential flow membrane assembly and reintroducing said fluid to a second portion of the intra-fiber volume of the first and/or second tangential flow membrane assembly; and

ii. a pump operationally interposed in the path of fluid communication of (a)(i); and/or

(b) a means for circulating fluid in the extra-fiber volume of the first and/or second tangential flow membrane assembly comprising:

i. a means for providing a path of fluid communication for removing fluid from a first portion of the extra-fiber volume of the first and/or second tangential flow membrane assembly and reintroducing said fluid to a second portion of the extra-fiber volume of the first and/or second tangential flow membrane assembly; and

ii. a pump operationally interposed in the path of fluid communication of (b)(i).

100. (Previously presented) The mass transfer system of claim 99 further comprising a reservoir interposed in the path of fluid communication of (a)(i) and/or (b)(i).

101. (Previously presented) The mass transfer system of claim 85 further comprising a means for the addition of one or more gases to the extra-filter space of the first and/or second tangential flow membrane assembly.

102. (Previously presented) A mass transfer system comprising:

(a) a first tangential flow membrane assembly comprising one or more filter elements separating the interior volume of said first tangential flow membrane assembly into

two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(b) a second tangential flow membrane assembly in fluid communication with one or more of the chambers of the first tangential flow membrane assembly, said second tangential flow membrane assembly comprising one or more filter elements separating the interior volume of the second tangential flow membrane assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(c) one or more substance addition means in fluid communication with one or more of the chambers of the first and/or second tangential flow membrane assembly; and

(d) a fluid exit means in fluid communication with the first and/or second tangential flow membrane assembly.

103. (Previously presented) The mass transfer system of claim 102, wherein a first set of one or more chambers of the first tangential flow membrane assembly are connected in fluid communication with a first set of one or more chambers of the second tangential flow membrane assembly such that fluid exiting the first set of one or more chambers of the first tangential flow membrane assembly flows into the first set of one or more chambers of the second tangential flow membrane assembly, and fluid exiting the first set of one or more chambers of the second tangential flow membrane assembly flows into the first set of one or more chambers of the first tangential flow membrane assembly.

104. (Previously presented) The mass transfer system of claim 102, further comprising a reservoir interposed in the path of fluid communication between the first tangential flow membrane assembly and the second tangential flow membrane assembly.

105. (Previously presented) A mass transfer system comprising:

(a) a medium reservoir comprising a growth medium;

(b) a tangential flow growth assembly in fluid connection with the medium reservoir, comprising one or more filter elements separating the interior volume of said tangential flow growth assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(c) a pump system operationally positioned in a path of fluid communication between the reservoir and the tangential flow growth device, for pumping the growth medium from the reservoir to the tangential flow growth device;

(d) a barrier tangential flow membrane assembly connected in fluid communication with one or more of the extra- or intra-filter chambers of the tangential flow growth assembly, comprising one or more filter elements separating the interior volume of said barrier tangential flow membrane assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume; and

(e) a means for monitoring medium conditions.

106. (Previously presented) The mass transfer system of claim 105, further comprising a tangential flow filtering assembly in fluid communication with the medium reservoir for concentrating and/or dialyzing the growth medium.

107. (Previously presented) The mass transfer system of claim 106, wherein the barrier membrane assembly is in fluid communication with one or more of the extra-filter chambers of the tangential flow growth assembly.

108. (Previously presented) The mass transfer system of claim 105, wherein said pump system comprises discharge and inlet ports for pumping the growth medium from the reservoir to the tangential flow growth device.

109. (Previously presented) A mass transfer system comprising:

(a) a medium reservoir comprising a growth medium;

(b) a tangential flow growth assembly in fluid connection with the medium reservoir, comprising one or more filter elements separating the interior volume of said tangential flow growth assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(c) a pump system operationally positioned in the path of fluid communication between the reservoir and the tangential flow growth device, for pumping the growth medium from the reservoir to the tangential flow growth device;

(d) a means for monitoring medium conditions; and

(e) an auxiliary flow circuit comprising an auxiliary pump, joined in fluid communication with the tangential flow growth device and arranged for flowing cell culture from the tangential flow growth device through the auxiliary flow circuit for recirculation thereof.

110. (Previously presented) The mass transfer system of claim 109, wherein said auxiliary flow circuit further comprises an auxiliary reservoir.

111. (Previously presented) A mass transfer system, comprising:

(a) a medium reservoir containing a growth medium;

(b) a barrier tangential flow membrane assembly comprising one or more filter elements separating the interior volume of said barrier tangential flow membrane assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(c) a pump system operationally positioned in a path of fluid communication between the reservoir and the barrier tangential flow membrane assembly for pumping the growth medium from the reservoir to the barrier tangential flow membrane assembly;

(d) a means for monitoring medium conditions.

112. (Previously presented) The mass transfer system of claim 111, further comprising a tangential flow filter assembly for concentrating and/or dialyzing the growth medium removed via said barrier tangential flow membrane assembly, said tangential flow filter assembly comprising one or more filter elements separating the interior volume of said tangential flow filter assembly into tow or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume.

113. (Previously presented) A mass transfer system, comprising:

(a) a medium reservoir containing a growth medium;

(b) a tangential flow growth assembly connected to the medium reservoir, said tangential flow growth assembly comprising one or more filter elements for separating the interior volume of said tangential flow growth assembly into two

or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(c) a pump system operationally positioned in a path of fluid communication between the reservoir and the tangential flow growth assembly for pumping the growth medium from the reservoir to the tangential flow growth assembly;

(d) a means for circulating fluid in the extra-capillary space of the tangential flow growth assembly;

(e) a reservoir for the fluid in the extra-capillary space of the tangential flow growth assembly;

(f) a means for removing the fluid from the extra-capillary space;

(g) a means for monitoring medium conditions; and

(h) a tangential flow filter assembly for concentrating and/or dialysis of the growth medium, said tangential flow filter assembly comprising one or more filter elements separating the interior volume of said tangential flow filter assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume.

114. (Previously presented) A mass transfer system, comprising:

(a) a medium reservoir containing a growth medium;

(b) a tangential flow growth assembly connected to the medium reservoir, said tangential flow growth device comprising one or more filter elements separating the interior volume of said tangential flow growth assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(c) a pump system operationally positioned in a path of fluid communication between the reservoir and the tangential flow growth assembly for pumping the growth medium from the reservoir to the tangential flow growth assembly;

(d) a means for circulating fluid in the extra-capillary space of the tangential flow growth assembly;

(e) a reservoir for the fluid and cells in the extra-capillary space of the tangential flow growth assembly;

(f) a means for removing the fluid from the extra-capillary space that includes a barrier filter;

(g) a means for monitoring medium conditions; and

(h) a tangential flow filter assembly for concentrating and/or dialysis of the growth medium, said tangential flow filter assembly comprising one or more filter elements separating the interior volume of said tangential flow filter assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume.

115. (Previously presented) A method for separating one or more components from an input fluid, said method comprising:

(a) providing a first tangential flow assembly comprising one or more filter elements separating the interior volume of said first tangential flow assembly into a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(b) providing a second tangential flow assembly comprising one or more filter elements separating the interior volume of said second tangential flow assembly into a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(c) introducing a first fluid into the first set of chambers of the first tangential flow assembly, such that a permeate comprising a first permeate component from said first fluid traverses the one or more filter elements of the first tangential flow assembly and enters the second set of chambers thereof, to provide a second fluid comprising the first permeate component;

(d) removing the second fluid from the second set of chambers of the first tangential flow assembly; and

(e) introducing the second fluid collected in step (d) into the first set of chambers of the second tangential flow assembly, such that a permeate comprising the first permeate component and/or a second permeate component traverses the one or more filter elements of said second tangential flow assembly and enters the second set of chambers thereof, to provide a third fluid comprising the first and/or second permeate component.

116. (Previously presented) The method of claim 115, further comprising the following steps:

(a) providing one or more additional tangential flow assemblies, each of which comprises one or more filter elements separating the interior volume of said

additional tangential flow assembly into a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(b) introducing an input fluid comprising the first, second and/or third fluid into the first set of chambers of one of said additional tangential flow assemblies, such that additional permeate traverses the one or more filter means of one of said additional tangential flow assemblies and enters the second set of chambers thereof, to provide an output fluid in the second set of chambers thereof; and

(c) repeating step (b) for each of said additional tangential flow assemblies, with the exception that the input fluid in each repetition of step (b) comprises a separated component of the input fluid and/or a more concentrated form of a component of the input fluid.

117. (Previously presented) The method of claim 116, wherein said first, second, and additional tangential flow assemblies are joined in serial fluid communication, with the first and/or second set of chambers of each tangential flow assembly being joined in fluid communication to the first and/or set of chambers of a succeeding tangential flow assembly.

118. (Previously presented) A method of inactivating a pathogen in an aqueous biological solution which contains a substance of interest, the method comprising:

(a) providing a tangential flow assembly comprising one or more filter elements separating the interior volume of said tangential flow assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(b) providing a reservoir in fluid communication with said tangential flow assembly, the reservoir comprising said aqueous biological solution that contains a pathogen;

(c) adding an inactivation agent to the reservoir;

(d) incubating the aqueous biological solution in the reservoir with the inactivating agent; and

(e) separating the inactivating agent from the substance of interest by flowing the aqueous biological solution from the reservoir through the first set of chambers of the tangential flow assembly and back to the reservoir, so as to generate a permeate stream;

wherein either the inactivating agent or the substrate of interest is retained in said first set of chambers of the tangential flow assembly, and the other of the inactivating agent and the substance of interest passes from the first set of chambers through the one or more filter elements to the second set of chambers with the permeate stream.

119. (Previously presented) A method of removing a pathogen from a solution comprising said pathogen and a substance of interest, the method comprising:

(a) providing a tangential flow assembly comprising one or more filter elements separating the interior of said tangential flow assembly into a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(b) providing a reservoir in fluid communication with the tangential flow assembly;

(c) flowing the solution from the reservoir through the first set of chambers of the tangential flow assembly and back to the reservoir, so as to generate a permeate stream passing into the second set of chambers, wherein either the pathogen or the substance of interest is retained in said first set of chambers of the tangential flow assembly, and the other of the pathogen or the substance of interest passes from the first set of chambers through the one or more filter elements of the tangential flow assembly to the second set of chambers with the permeate stream; and

(d) adding a dialyzing solution to the reservoir for increasing permeation of the pathogen and/or the substance of interest.

120. (Previously presented) The method of claim 119, wherein said solution comprises an aqueous biological solution.

121. (Previously presented) The method of claim 119, wherein said solution comprises blood.

122. (Previously presented) A method of producing and isolating a metabolic product of a culturable organism, the method comprising:

(a) providing a reservoir comprising a culture fluid;

(b) providing a first tangential flow membrane assembly suitable for retaining cells, wherein said first tangential flow membrane assembly is in fluid communication with the reservoir, and wherein said first tangential flow membrane assembly comprises one or more filter elements separating the interior volume of said first tangential flow

membrane assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(c) flowing the culture fluid from the reservoir through first set of chambers of the first tangential flow membrane assembly and back to the reservoir, so as to generate a first permeate stream;

(d) monitoring the culture fluid for one or more parameters selected from the group consisting of oxygen, pH, temperature, and CO_2;

(e) providing a means for adding to the culture fluid one or more supplements selected from the group consisting of oxygen, culture media, acids, bases, buffers and cellular nutrients;

(f) inoculating the culture fluid with a culturable organism;

(g) providing a second tangential flow membrane assembly suitable for concentrating or isolating the metabolic product, wherein said second tangential flow membrane assembly comprises one or more filter elements separating the interior volume of said second tangential flow membrane assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(h) removing the first permeate fluid from I; and

(i) flowing the first permeate fluid through the first set of chambers of the second tangential flow membrane assembly, so as to generate a second permeate stream, thereby concentrating or isolating the metabolic product.

123. (Previously presented) A method of culturing cells comprising:

(a) providing a first reservoir comprising a culture fluid;

(b) providing a first tangential flow membrane assembly suitable for retaining cells, wherein said first tangential flow membrane assembly is in fluid communication with the first reservoir, and wherein said first tangential flow membrane assembly comprises one or more filter elements separating the interior volume of said first tangential flow membrane assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(c) flowing the culture fluid from the first reservoir through the first tangential flow membrane device and back to the first reservoir, so as to generate a permeate stream;

(d) monitoring the culture fluid for one or more parameters selected from the group consisting of oxygen, pH, temperature and CO_2;

(e) providing a means for addition of one or more supplements selected from the group consisting of oxygen, culture media, acids, bases, buffers and cellular nutrients;

(f) inoculating the culture fluid contained in the second set of chambers of the first tangential flow membrane assembly with a culturable organism;

(g) providing a second reservoir in fluid communication with the second set of chambers of the first tangential flow membrane assembly;

(h) providing a means for flowing fluid from the second reservoir through the second set of chambers of the first tangential flow membrane assembly and back to the second reservoir.

124. (Previously presented) The method according to claim 123, further comprising:

(a) providing a second tangential flow membrane assembly comprising:

(i) one or more filter elements separating the interior volume of said second tangential flow membrane assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(ii) at least one entrance port and at least one exit port in fluid communication with the first set of chambers of the second tangential flow membrane assembly; and

(iii) at least one entrance and/or exit port in fluid communication with the second set of chambers of the second tangential flow membrane assembly;

(b) attaching the second tangential flow membrane assembly in fluid communication with the first reservoir and the first tangential flow membrane assembly via the entrance and exit ports of the first set of chambers of the second tangential flow membrane assembly provided in (a)(ii); and

(c) attaching a suitable gas supply to the entrance port of the second set of chambers of the second tangential flow membrane assembly provided in (a)(iii).

125. (Previously presented) A method of producing and isolating a metabolic product of a culturable organism, the method comprising:

(a) providing a first reservoir comprising a culture fluid;

(b) providing a first tangential flow membrane assembly suitable for retaining cells, wherein said first tangential flow membrane assembly is in fluid communication with

the first reservoir, and wherein said first tangential flow membrane assembly comprises one or more filter elements separating the interior volume of said first tangential flow membrane assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(c) flowing the culture fluid from the first reservoir through the first set of chambers of the first tangential flow membrane assembly and back to the reservoir;

(d) monitoring the culture fluid for one or more parameters selected from the group consisting of oxygen, pH, temperature, and CO_2;

(e) providing a means for adding to the culture fluid one or more supplements selected from the group consisting of oxygen, culture media, acids, bases, buffers and cellular nutrients;

(f) inoculating the culture fluid with a culturable organism;

(g) providing a second tangential flow membrane assembly suitable for isolating the metabolic product, wherein said second tangential flow membrane assembly is in fluid communication with the first set of chambers of the first tangential flow membrane assembly, and wherein said second tangential flow membrane assembly comprises one or more filter elements separating the interior volume of said second tangential flow membrane assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(h) flowing the culture fluid through the first set of chambers of the second tangential flow membrane assembly, so as to generate a permeate stream.

126. (Previously presented) The method of claim 125, wherein the second tangential flow membrane assembly concentrates the metabolic product.

127. (Previously presented) A method of inactivating a pathogen in a solution which contains a substance of interest, the method comprising:

(a) providing a tangential flow device comprising one or more filter elements separating the interior volume of said tangential flow membrane assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(b) providing a reservoir in fluid communication with the tangential flow device, the reservoir comprising a solution comprising a viral pathogen;

(c) adding a virus-destroying chemical to the reservoir;

(d) incubating the solution in the reservoir with the virus-destroying chemical; and

(e) separating the virus-destroying chemical from the substance of interest, by flowing the solution from the reservoir through the first set of chambers of the tangential flow assembly and back to the reservoir, so as to generate a permeate stream;

wherein either the virus-destroying chemical or the substance of interest is retained in the first set of chambers of the tangential flow membrane assembly, and the other of the virus-destroying chemical and the substance of interest passes from the first set of chambers through the one or more filter elements of the tangential flow membrane assembly to the second set of chambers with the permeate stream.

128. (Previously presented) A method of inactivating a pathogen in a solution which contains blood and a substance of interest, the method comprising:

(a) providing a tangential flow assembly comprising one or more filter elements separating the interior volume of said tangential flow assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(b) providing a reservoir in fluid communication with said tangential flow assembly, the reservoir comprising a solution comprising a pathogen;

(c) adding an inactivation agent to the reservoir to inactivate the pathogen;

(d) incubating the blood-comprising solution in the reservoir with the inactivating agent; and

(e) separating the inactivating agent from the substance of interest by flowing the solution from the reservoir through the first set of chambers of the tangential flow assembly and back to the reservoir, so as to generate a permeate stream;

wherein either the inactivating agent or the substrate of interest is retained in said first set of chambers of the tangential flow assembly, and the other of the inactivating agent and the substance of interest passes from the first set of chambers through the one or more filter elements to the second set of chambers with the permeate stream.

129. (Previously presented) A method for the production and subsequent viral reduction of a metabolic product of interest produced by a culturable organism, the method comprising:

(a) providing a first reservoir comprising a culture fluid;

(b) providing a first tangential flow membrane assembly suitable for retaining cells, wherein said first tangential flow membrane assembly is in fluid communication with the first reservoir, and wherein said first tangential flow membrane assembly comprises one or more filter elements separating the interior volume of said first tangential flow membrane assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(c) flowing fluid from the first reservoir through the first set of chambers of the first tangential flow membrane assembly and back to the reservoir;

(d) monitoring the culture fluid for one or more parameters selected from the group consisting of oxygen, pH, temperature, and CO_2;

(e) adding to the culture fluid one or more supplements selected from the group consisting of oxygen, culture media, acids, bases, buffers and cellular nutrients;

(f) inoculating the culture fluid contained in the second set of chambers of the first tangential flow membrane assembly with a culturable organism capable of producing a metabolic product of interest;

(g) providing a second reservoir suitable for receiving fluid from the second set of chambers of the first tangential flow membrane assembly;

(h) providing a second tangential flow membrane assembly suitable for the retention of virus and passage of the metabolic product of interest, wherein said second tangential flow membrane assembly is in fluid communication with the second reservoir, and wherein said second tangential flow membrane assembly comprises one or more filter elements separating the interior volume of said second tangential flow membrane assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(i) transferring fluid from the second set of chambers of the first tangential flow membrane assembly to the second reservoir;

(j) flowing fluid from the second reservoir through the first set of chambers of the second tangential flow membrane assembly and back to the second reservoir, so as to generate a permeate stream;

(k) optionally, adding a dialyzing solution and/or one or more inactivating agents to the second reservoir.

130. (Previously presented) The method of claim 129, wherein the step of adding a dialyzing solution and/or one or more inactivating agents to the second reservoir is accomplished with an appropriate incubation period.

131. (Previously presented) A method for the production and subsequent viral reduction of a metabolic product of interest produced by a culturable organism, the method comprising:

(a) providing a first reservoir comprising a culture fluid;

(b) providing a first tangential flow membrane assembly suitable for retaining cells, wherein said first tangential flow membrane assembly is in fluid communication with the first reservoir, and wherein said first tangential flow membrane assembly comprises one or more filter elements separating the interior volume of said first tangential flow membrane assembly into two or more chambers, including a first set of chambers comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(c) flowing fluid from the first reservoir through the first set of chambers of the first tangential flow membrane assembly and back to the reservoir to generate a permeate stream;

(d) monitoring the culture fluid for one or more parameters selected from the group consisting of oxygen, pH, temperature, and CO_2;

(e) adding to the culture fluid one or more supplements selected from the group consisting of oxygen, culture media, acids, bases, buffers and cellular nutrients;

(f) inoculating the culture fluid contained in the second set of chambers of the first tangential flow membrane assembly with a culturable organism capable of producing a metabolic product of interest;

(g) providing a second reservoir suitable for receiving fluid from the second set of chambers of the first tangential flow membrane assembly;

(h) providing a second tangential flow membrane assembly suitable for the retention of virus and passage of the metabolic product of interest, wherein said second tangential flow membrane assembly is in fluid communication with the second reservoir, and wherein said second tangential flow membrane assembly comprises one or more filter elements separating the interior volume of said second tangential flow membrane assembly into two or more chambers, including a first set of chambers

comprising an intra-filter volume and a second set of chambers comprising an extra-filter volume;

(i) transferring fluid from the second set of chambers of the first tangential flow membrane assembly to the second reservoir;

(j) flowing fluid from the second reservoir through the first set of chambers of the second tangential flow membrane assembly and back to the second reservoir, so as to generate a permeate stream comprising the substance of interest, while retaining the virus;

(k) optionally, adding a dialyzing solution and/or one or more inactivating agents to the second reservoir.

132. (Previously presented) The method of claim 131, wherein the step of adding a dialyzing solution and/or one or more inactivating agents to the second reservoir is accomplished with an appropriate incubation period.

133. (Previously presented) The mass transfer system of claim 85 wherein the first set of chambers and the second set of chambers of the first and/or second tangential flow membrane assembly are positioned side-by-side.

134. (Previously presented) The mass transfer system of claim 85 wherein the first set of chambers and the second set of chambers of the first and/or second tangential flow membrane assembly are positioned coaxially.

135. (Previously presented) The mass transfer system of claim 85 wherein the first and the second tangential flow membrane assemblies are positioned coaxially to each other.

136. (Previously presented) The method of claim 115 wherein the filter elements comprise one or more hollow fiber filters.

137. (Previously presented) The method of claim 115 wherein the first set of chambers and the second set of chambers of the first and/or second tangential flow membrane assembly are positioned side-by-side.

138. (Previously presented) The method of claim 115 wherein the first and/or second tangential flow membrane assembly are positioned side-by-side.

139. (Previously presented) The method of claim 115 wherein the first set of chambers and the second set of chambers of the first and/or second tangential flow membrane assembly are positioned coaxially.

140. (Previously presented) The method of claim 115 wherein the first and the second tangential flow membrane assemblies are positioned coaxially to each other.

141. (Previously presented) The mass transfer system of claim 115 wherein the first and/or second tangential flow membrane assembly comprises multiple filter elements in parallel or serial connection.